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Cost and utilization of power and equipment on farms in the Mississippi River Delta Cotton Area of Louisiana

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COST AND UTILIZATION OF POWER AND EQUIPMENT ON FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA OF LOUISIANA

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TABLE OF CONTENTS

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Cost and Utilization of Power and Equipment on Farms in the Mississippi River Delta Cotton Area of Louisiana

Frank D. Barlow, Jr., and Leo J. Fenske[1]

INTRODUCTION

The South has lagged behind the Corn Belt and other areas of the United States in the rate at which tractor power has displaced horse and mule power. The main reason for this is that the production of intensive labor crops like cotton, tobacco, peanuts, and sweet potatoes does not lend itself readily to complete mechanization. In addition the high ratio of farm people to physical resources has been a retarding factor. In recent years, however, an increase in non-farm employment opportunities at attractive wages has resulted in higher wages for labor on farms and advancements in the mechanization of nearly all farm operations. The government control programs that reduced or curtailed acreages of such cash crops as cotton, tobacco, and peanuts, has stimulated greater diversification throughout the southern region and encouraged the trend toward more extensive farming systems and crops that were readily adaptable to mechanized methods.

The first tractors were used in the delta about 1915, but numbers did not increase very rapidly until in the late 1920's when the general-purpose-type tractor was developed. The introduction of rubber tires on tractors, and the all-round improvement in both tractors and tractor equipment made tractors more versatile as a source of power. The trend toward farm mechanization has been very rapid during the war period, as is evidenced by the increase in tractor numbers from 1940 to 1944 (Table 1). The general acceptance of mechanized methods in recent years and the anticipated improvement and development of new mechanical techniques during the next few years, suggest the need for

[1] Louisiana Agricultural Experiment Station and Bureau of Agricultural Economics, respectively.

FIGURE 1.—Location of the area.

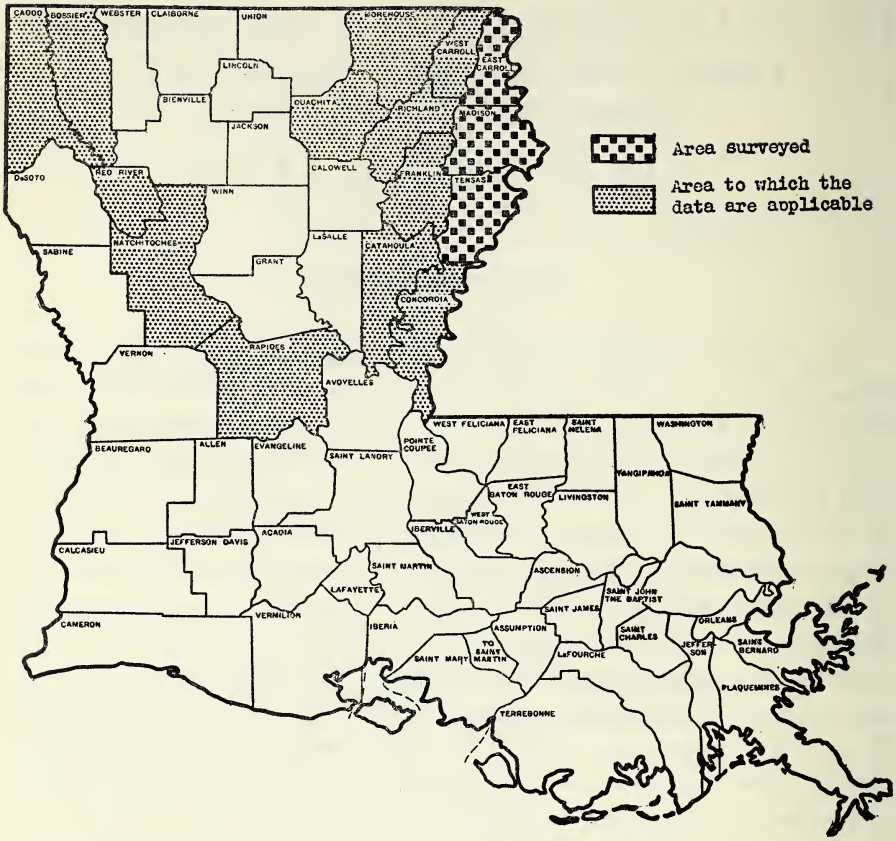

TABLE 1. NUMBER OF TRACTORS ON FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1930-44[1]

Parish	*1930*	*1940*	*1942*	*1944*
Catahoula	55	112	148	181
Concordia	47	181	350	379
East Carroll	65	176	352	355
Franklin	54	247	600	658
Madison	67	234	265	318
Morehouse	44	122	321	325
Ouachita	58	109	250	295
Richland	39	156	300	342
Tensas	108	221	525	534
West Carroll	14	153	375	380
Total	551	1711	3486	3767

[1]Source: U.S. Census. Data for 1942 and 1944 were compiled from AAA farm plans and rationing certificates.

specific information on the cost and utilization of alternative power systems.

A study of farm power and equipment in relation to the organization of farms as it affects profitable crop combinations was made in the Mississippi River Delta Cotton Area of Louisiana in the spring of 1945. This bulletin presents the results obtained that relate to the cost and utilization of power and equipment on delta farms. The subject matter is organized around the following main topics: (1) cost and utilization of tractor power, (2) cost and utilization of animal power, (3) cost and utilization of complementary tractor and workstock equipment, (4) rates of performing farm operations with mechanical and animal power systems, (5) a comparison of man labor and power utilization in crop production with mechanical and animal power, and (6) the problem of reducing power and equipment costs.

The farm mechanization survey was conducted in East Carroll, Madison, and Tensas Parishes, which are within the boundaries of the type-of-farming area commonly known as the Mississippi River Delta Cotton Area. It is believed that the data obtained from this survey are reasonably applicable throughout the other parishes of this area and also to the Red River Delta Cotton Area in the northwestern part of the state. The area surveyed and the area for which the results are partially applicable are outlined in Figure 1.

Sampling Procedure

The delta cotton areas have long been characterized by the plantation system and a relatively large number of small independent family-operated farms. As a rule the large plantations are concentrated along the river or bayou fronts on the most desirable delta soils. Small farms are interspersed among the plantations but tend to be concentrated more in the back lands and new ground areas.

In order to obtain a representative sample that was statistically reliable for the principal farming systems prevailing in the area, it was necessary to stratify the farms as to size. Four groups of farms were selected as follows: (1) Small farms with less than 50 acres in crops, (2) farms with 50-149 acres in crops, (3) farms with 150-299 acres in crops, and (4) farms with 300 acres or more in crops but less than 1,500 acres in crops. As a rule plantation units with more than 1,500 acres in crops are not typical and for this reason were excluded from the survey. Within the four groups 120 farms were selected at random for detailed study.

Organization of Farms Surveyed

The use of land on the farms surveyed is given in Table 2. The smaller farms had the highest proportion of land area in cropland.

Approximately 65 per cent of the total farm acreage on these farms was in cropland, as compared with 47 per cent on farms in the 50-149 acre group. In the two large-size groups about 40 per cent of the total acreage was cropland. Relatively less farm land was idle on the plantations with 300 acres of cropland and over than on farms in the smaller size groups.

TABLE 2. Land Use on 120 Farms in the Mississippi River Delta Cotton Area, 1944

Land Use	*Size of Farm*[1]			
	Less than 50	*50–149*	*150–299*	*300 and over*
Average per farm:	*acres*	*acres*	*acres*	*acres*
Tilled cropland	33.1	91.9	222.9	622.0
Idle cropland	3.6	9.0	26.7	15.9
Total cropland	36.7	100.9	249.6	637.9
Permanent pasture (open)	8.0	21.8	59.9	107.2
Woodland pasture	4.9	36.5	147.9	405.6
Woods and waste	7.4	53.8	167.4	472.1
Total farm land	57.0	213.0	624.8	1,622.8
Number of farms	39	29	27	25

[1]Based on acres in crops.

The average cotton acreage exceeded that of any other crop in all groups, and corn ranked second, except on the farms in the 150-299 acre group, where the acreage planted to oats was greater than the acreage in corn (Table 3). Oats and lespedeza were relatively more important on farms having more than 150 acres in crops. Soybeans for beans were important on farms in the large group. From 20 to 30 per cent of the total cropland tilled on all farms was planted to winter legumes.

Workstock numbers ranged from 2 head per farm on the small farms to an average of 19 head per farm on the large farms of over 300 acres in crops (Table 4). Nearly all workstock were mules.

Milk cows are kept mainly to produce milk for home use, and the average number ranged from 2 head on the small farms to 5 head on the largest farms. The larger farm operators kept substantial numbers of beef cattle, as is evidenced by an average of 138 per farm on the farms containing 300 or more acres in crops. Brood sow numbers averaged about 1 per farm for the two smaller groups, 1.6 per farm for the third group, and 6.4 per farm in the large group of 300 acres and over.

In the group of farms with less than 50 acres in crops, 22 farms were operated entirely with mules and 17 recently had shifted to tractors as

TABLE 3. CROP ORGANIZATION ON 120 FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Crop Organization	*Size of Farm*[1]							
	Less than 50		*50–149*		*150–299*		*300 and over*	
Average per farm:	*acres*	*per cent*	*acres*	*per cent*	*acres*	*per cent*	*acres*	*per cent*
Cotton	13.0	39.3	31.2	34.0	88.8	39.8	235.7	37.9
Corn	12.9	39.0	31.1	33.8	41.7	18.7	146.6	23.6
Oats	2.8	8.4	15.3	16.7	59.2	26.6	142.5	22.9
Soybeans for beans	0.6	1.8	5.7	6.2	15.6	7.0	36.6	5.9
Soybeans for hay	....	....	0.2	0.2	1.3	0.6	3.6	0.6
Lespedeza	2.5	7.6	14.1	15.3	39.7	17.8	109.5	17.6
Alfalfa	0.5	1.5	1.3	1.4	4.3	1.9	6.7	1.1
Singletary peas for seed	1.0	3.0	3.0	3.3	2.7	1.2	17.8	2.8
Other crops	1.7	5.1	10.6	11.5	16.5	7.4	42.8	6.9
Garden	0.6	1.8	0.2	0.2	0.1	0.0	0.2	0.0
Adjustment for multiple use[2]	2.5	7.5	20.8	22.6	47.0	21.0	120.0	19.3
Total cropland tilled	33.1	100.0	91.9	100.0	222.9	100.0	622.0	100.0
Winter legumes turned under	9.5	28.7	18.0	91.6	71.3	32.0	135.5	21.8
Soybeans interplanted	6.0	18.1	16.3	17.7	13.2	5.9	62.6	10.1
Number of farms	39	..	29	..	25	..	25	..

[1]Based on acres in crops.

[2]In making the adjustment for multiple use of land by crops, the first use in the crop year is considered to be the primary use.

TABLE 4. LIVESTOCK ORGANIZATION ON 120 FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, JANUARY 1, 1945

Livestock Organization	*Size of Farm*[1]			
	Less than 50	*50–149*	*150–299*	*300 and over*
Average per farm:	*number*	*number*	*number*	*number*
Mules	1.9	2.6	7.0	18.3
Horses	0.1	0.4	0.6	0.6
Total workstock	2.0	3.0	7.6	18.9
Other horses	0.2	0.4	1.0	2.4
Milk cows	2.3	3.2	3.1	4.5
All other cattle	4.1	19.4	30.6	138.1
Brood sows	0.9	1.1	1.6	6.4
Number of farms	39	29	27	25

[1]Based on acres in crops.

the main source of power. There were slight variations in crop and livestock organization on these farms, as is indicated in Tables 5 and 6. The

TABLE 5. Crop Organization on 39 Small Farms in the Mississippi River Delta Cotton Area, Classified by Type of Power System, 1944[1]

Crop Organization	*All Farms*	*Mule Farms*	*Tractor Farms*
Average per farm:	*acres*	*acres*	*acres*
Cotton	13.0	13.0	13.0
Corn	12.9	11.0	15.0
Oats	2.8	2.0	3.9
Soybeans for beans	0.6	0.6	1.4
Soybeans for hay	....	....	....
Lespedeza	2.5	2.2	2.9
Alfalfa	0.5	0.2	0.7
Singletary peas for seed	1.0	0.5	1.7
Other crops	1.7	2.6	0.5
Garden	0.6	0.4	0.8
Adjustment for multiple use[2]	2.5	2.5	3.1
Total cropland tilled	33.1	30.0	36.8
Winter legumes turned under	9.5	6.9	12.8
Soybeans interplanted	6.0	5.1	7.2
Number of farms	39	22	17

[1]Less than 50 acres in crops.

[2]In making the adjustment for multiple use of land by crops, the first use in the crop year is considered to be the primary use.

TABLE 6. Livestock Organization on 39 Small Farms in the Mississippi River Cotton Area, Classified by Type of Power System, 1944[1]

Livestock Organization	*All Farms*	*Mule Farms*	*Tractor Farms*
Average per farm:	*number*	*number*	*number*
Mules	1.9	2.2	1.4
Horses	0.1	0.2	0.0
Total workstock	2.0	2.4	1.4
Other horses	0.2	0.3	0.1
Milk cows	2.3	2.1	2.5
All other cattle	4.1	3.5	4.8
Brood sows	0.9	1.0	0.8
Number of farms	39	22	17

[1]Less than 50 acres in crops.

small tractor farms were slightly larger than those operated exclusively with mules. Both groups averaged 13 acres of cotton per farm. The tractor farms averaged 15 acres of corn as compared with 11 acres on the mule farms. Other crops were relatively unimportant in comparison with cotton and corn on small farms. The average acreage of winter legumes planted on small tractor farms was nearly double that on those operated with mules. The main differences in livestock numbers on these farms were in workstock numbers. The tractor farms averaged 1.4 head per farm as compared with 2.4 head per farm on the mule-powered farms. Cattle numbers averaged slightly higher on the tractor farms than on the mule farms. Each farm kept about 1 brood sow for producing home consumed pork.

COST AND UTILIZATION OF TRACTOR POWER

Data presented on the cost and utilization of tractor power are based on detailed records for 179 tractors of various sizes and wheel types that were found on the 120 farms included in the farm mechanization study. For purposes of analysis the tractors were divided into three size groups: small tractors, of less than 17 drawbar horsepower; medium, from 17 to 26.9 horsepower; and large, of 27 horsepower and over. The official drawbar horsepower rating as determined by the Agricultural Experiment Station of the University of Nebraska was the basis used in determining the drawbar horsepower of the various tractors.[2]

The cost of tractor operation varies widely and is dependent upon several factors. The principal factors, which are independent of the manner in which tractors are handled (or the care that is taken of them by the operator), are size, wheel type, and the amount of annual use. There are other factors that are more or less within the control of the farm operator and depend upon the care taken in actual operations and the adequacy of servicing and maintenance.

The costs presented are averages and should be interpreted as such. Considerable variations are found from farm to farm, as costs are above average on some farms and below average on others. In using these data care in interpretation should be exercised in light of individual considerations that may vary from farm to farm.

Relationship of Size to Cost of Operation

The size of tractor is a very important factor determining the absolute cost of tractor operation per day or per hour. The average cost of

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[2] See "Summary of Results of the Nebraska Tractor Tests," University of Nebraska, Department of Agricultural Engineering, Jan. 1, 1942, plus supplements. The horsepower ratings used were those determined in Test F giving 100 per cent maximum load.

operating all tractors, excluding the wages of the driver, was $5.58 per 10-hour day, or 56 cents an hour, in 1944 (Table 7). The cost of opera-

TABLE 7. AVERAGE COST PER 10-HOUR DAY AND PER HOUR OF OPERATING 179 TRACTORS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*All Tractors*	*Small*[1] *Tractors*	*Medium*[1] *Tractors*	*Large*[1] *Tractors*
Number tractors	179	18	107	54
Average horsepower rating[2]	25.13	15.62	23.58	31.38
Annual use, average days	94.8	93.2	89.3	106.3
Cash expenses:	*dollars*	*dollars*	*dollars*	*dollars*
Fuel (gasoline and fuel oil)	1.85	1.73	1.78	2.03
Grease, oil, and filters	.59	.47	.61	.61
Repairs	.90	.67	.89	.99
Service labor	.26	.23	.26	.27
Total	3.60	3.10	3.54	3.90
Overhead costs:				
Depreciation[3]	1.53	1.38	1.46	1.71
Interest[4]	.45	.37	.45	.48
Total	1.98	1.75	1.91	2.19
Average cost per 10-hour day	5.58	4.85	5.45	6.09
Average cost per hour	0.56	0.49	0.55	0.61

[1]Small tractors, less than 17 drawbar horsepower; medium tractors, 17 to 26.7 horsepower; and large tractors, 27 horsepower and over.

[2]Drawbar horsepower rating, Test F, Nebraska Tractor Tests.

[3]See Table 10 for average purchase price of tractors by size, and Table 11 for average useful life.

[4]Interest figured at 6 per cent on one-half of the average purchase price.

tion ranged from $4.85 a day for small tractors to $6.09 a day for large tractors. Cash expenses for fuel, repairs, and service labor account for approximately 64 per cent of the total cost of operation, and overhead costs for depreciation and interest account for the remaining 36 per cent. Fuel is the principal item of expense in the operation of tractors and depreciation is the second most important cost item.

Relationship of Wheel Type to Cost of Operation

Putting rubber tires on tractors has done much to expand the adaptability and increase the usefulness of tractors. This development has facilitated field-to-field transportation and has given greater comfort and convenience to operators. It has long been recognized that fuel consumption is generally less for tractors mounted on rubber and that operating costs are lower, but specific information on the actual difference in cost under practical farm conditions is limited.

Of the 179 tractors for which detailed information was obtained, 114 were mounted on rubber and the remaining 65 tractors were mounted on steel. The 65 tractors mounted on steel were composed of both old-type tractors and new tractors that were manufactured during the war when rubber was scarce. There is a general tendency on the part of farmers who have relatively new steel-rimmed tractors to convert to rubber.

The variation in cost of operation due to type of wheel is presented in Table 8. The average cost of operating all tractors mounted on rubber was $5.48 per 10-hour day, or 55 cents an hour, as compared with $5.80 a day, or 58 cents an hour, for those that were mounted on steel—a margin of 3 cents an hour in favor of rubber-tired tractors.

The average cost ranged from $4.98 per 10-hour day for small tractors on rubber to $5.85 for large tractors on rubber. For tractors on steel the average cost was $4.48 per 10-hour day for small tractors and $6.88 for large tractors. The whole story is not told in this comparison, as the average horsepower rating was greater for those tractors mounted on rubber than for those on steel—25.91 horsepower rating as compared with 23.67. Consequently, the higher horsepower rating of tractors mounted on rubber tends to conceal their lower operating cost. In using these data it is necessary to compare the drawbar horsepower ratings for tractors in each group as they relate to costs of operation.

Cash expenses for all items, fuel, grease, oil, oil filters, repairs, and service labor, were less for tractors mounted on rubber than for those mounted on steel, even though the average drawbar horsepower rating was higher. Overhead costs for depreciation and interest were about the same for each group because tractors mounted on rubber were used more days annually than those on steel—103.6 days as compared with 78.5 days.[3]

Relationship of Days Used Annually to Cost of Operation

The number of days or hours that a tractor is used annually is the most important single factor causing variations in the cost of tractor operation from farm to farm. Every farm operator must give practical consideration to this factor if he is to achieve minimum costs of tractor operation. The fundamental economic principle of spreading overhead costs is involved here. Overhead costs for interest and depreciation prevail whether or not the tractor is used, but operating costs vary almost directly with the amount of use. The overhead costs for interest and depreciation are relatively fixed. Depreciation results from wear and tear due to use and also to obsolesence when not used at all. Therefore if a tractor is used only a few days annually, the overhead costs per day

[3] See Table 14 on page 18.

TABLE 8. AVERAGE COST PER 10-HOUR DAY AND PER HOUR OF OPERATING 179 TRACTORS, CLASSIFIED BY TYPE OF WHEEL AND SIZE OF TRACTOR, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	All tractors	Rubber tires				Steel wheels			
		Small[1]	Medium[1]	Large[1]	All Rubber	Small[1]	Medium[1]	Large[1]	All Steel
Number tractors	179	14	58	42	114	4	49	12	65
Average horsepower rating[2]	25.13	16.04	24.13	31.65	25.91	14.14	22.93	29.85	23.67
Annual use, number of days	94.8	95.0	98.0	114.3	103.6	86.8	78.0	78.0	78.5
	dollars	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*
Cash expenses:									
Fuel	1.85	1.72	1.74	1.96	1.82	1.79	1.82	2.30	1.91
Grease	.15	.13	.14	.13	.14	.13	.19	.21	.19
Oil	.35	.26	.34	.37	.34	.22	.37	.33	.35
Oil filters	.09	.09	.08	.10	.09	.11	.10	.11	.10
Repairs	.90	.71	.85	.92	.86	.53	.97	1.14	.97
Service labor	.26	.22	.24	.27	.25	.27	.29	.28	.29
Total	3.60	3.13	3.39	3.75	3.50	3.05	3.74	4.37	3.81
Overhead expenses:									
Depreciation[3]	1.53	1.48	1.53	1.68	1.58	1.07	1.38	1.80	1.44
Interest[4]	.45	.37	.39	.42	.40	.36	.52	.71	.55
Total	1.98	1.85	1.92	2.10	1.98	1.43	1.90	2.51	1.99
Average cost per 10-hour day	5.58	4.98	5.31	5.85	5.48	4.48	5.64	6.88	5.80
Average cost per hour	0.56	0.50	0.53	0.59	0.55	0.45	0.56	0.69	0.58

[1]Small tractors, of less than 17 drawbar horsepower; medium tractors, 17 to 26.9 horsepower; and large tractors, 27 horsepower and over.
[2]Drawbar horsepower rating, Test F, Nebraska Tractor Tests.
[3]See table 10 for average purchase price of tractors by size, and table 11 for average useful life.
[4]Interest figured at 6 per cent of one-half the average purchase price.

or per hour will be high. If it is fully and effectively used throughout the year, the overhead costs per day will be smaller, depending upon the amount of annual use.

The relationship of the number of 10-hour days used per year and the cost of tractor operation is presented in Table 9. The 179 tractors were sorted and grouped on the basis of the number of 10-hour days used annually. As the number of days of annual use increases, the cost of tractor operation per day and per hour declines, up to a certain point.

TABLE 9. Relationship of the Number of Days used per Year and the Cost of Operation for 179 Tractors in the Mississippi River Delta Cotton Area, 1944

Annual 10-hour Days of Use	*Number Tractors*	*Average Days Used*	*Average Operating Expenses per 10-hour Day*		
			Cash	*Overhead*	*Total*
Group:			*dollars*	*dollars*	*dollars*
Less than 60	32	45	4.25	3.12	7.37
60-89	54	73	3.71	2.11	5.82
90-119	41	103	3.37	1.69	5.06
120-149	36	130	3.20	1.43	4.63
150 and over	16	169	3.44	1.19	4.63
All tractors	179	95	3.60	1.98	5.58

Tractors that were used less than 60 days a year were used on an average of 45 days, and the average cost of operation was $7.37 a day, or 74 cents an hour. Cash costs were higher for tractors that were used less than 60 days a year because certain servicing charges are annual in nature, such as transmission oil changes, hydraulic system changes, etc. The average number of days of use for all tractors was 95, and the average cost per day was $5.58, or 56 cents an hour. For those tractors that were used on an average of 130 days a year, the average cost of operation was $4.63, or 46 cents an hour. Only 16 tractors were used more than 150 days annually, and the average cost of operation was $4.63 a day, the same as for those that were used 130 days annually. Higher operating costs for repairs offset the lower overhead costs for depreciation and interest for these tractors. On the basis of this analysis of 179 tractors, it appears that minimum costs of operation are achieved when tractors are used 120 days a year or more, but little or no reduction in cost of operation is achieved beyond 150 days of annual use. Those tractors that are used more than 150 days annually in the Mississippi River Delta Cotton Area are used for rough work in drainage improvement, land clearing, and logging in addition to regular farm operations. This probably accounts for the higher repair costs that offset the lower overhead costs.

Information on Tractors, Tires, and Fuel Consumption

Purchasing Price of Tractors and Tires—The average purchase price of tractors, by wheel type and size, and the purchase price of tractor tires are presented in Table 10. The average purchase price for all tractors was $1,188, as compared with $1,217 for those mounted on rubber and $1,081 for those mounted on steel. These prices for tractors in the various size groups by wheel types were used in the calculation of overhead costs for depreciation and interest.

TABLE 10. Average Purchase Price of 179 Tractors, Front Tires, and Back Tires, by Wheel Type and Size of Tractor, in the Mississippi River Delta Cotton Area, 1944

Wheel Type and Size of Tractor	*Average Purchase Price*		
	Tractor[1]	*Tractor Tires*	
		Front	*Back*
	dollars	*dollars*	*dollars*
Rubber tires			
Small	944	24	124
Medium	1,148	27	158
Large	1,402	39	176
All rubber	1,217	31	160
Steel wheels			
Small	918	..	...
Medium	1,026	..	...
Large	1,358	..	...
All steel	1,081	..	...
All tractors			
Small	938	..	...
Medium	1,127	..	...
Large	1,392	..	...
All tractors	1,188	..	...

[1]Includes tires when used.

The average purchase price of front and rear tractor tires, by size of tractor, is also given in Table 10. The average purchase price of 2 front tires was reported to be $31 as compared with $160 for the rear tires.

Useful Life of Tractors and Tires—The average age of the 179 tractors studied was 5 years, and farmers estimated that 7 years of useful life remained. The total years of useful life, then, averaged 12 years for all tractors (Table 11). The average useful life of tractors mounted on rubber was 11.4 years as compared with 13 years for those mounted on steel. The present age of steel-rimmed tractors was 6.6 years, on an average, as compared with 4.2 years for those on rubber.

The fact that the total years of useful life was greater for steel-rimmed tractors than for those mounted on rubber may be confusing. Tractors

TABLE 11. Estimated Average Life of 179 Tractors, by Wheel Type and Size of Tractor in the Mississippi River Delta Cotton Area, 1944

Wheel Type and Size of Tractor	Life of Tractor		
	Present age, years	Remaining years	Total
Rubber tires			
Small	2.9	7.9	10.8
Medium	4.4	6.7	11.1
Large	4.3	7.6	11.9
All rubber	4.2	7.2	11.4
Steel wheels			
Small	2.8	9.3	12.1
Medium	7.0	6.0	13.0
Large	6.4	7.0	13.4
All steel	6.6	6.4	13.0
All tractors			
Small	2.8	8.2	11.0
Medium	5.5	6.5	12.0
Large	4.8	7.5	12.3
All tractors	5.0	7.0	12.0

on steel were not used as many days annually as those mounted on rubber—78.5 10-hour days as compared with 103.6 days. Therefore, a total of 1,181 10-hour days of use was estimated during the entire life of tractors mounted on rubber as compared with a total of 1,020 10-hour days for those mounted on steel. In other words, the total useful life of tractors mounted on rubber was estimated to be nearly 12 per cent more than for those mounted on steel under practical farm conditions in this area.

The life of tractor tires varies widely depending upon the amount of use that is made of the tractor and especially upon the care that is taken of the tires when the tractor is being used. When tractors are used in rough new ground or rough pasture land, the life of tires is much less than average. In order to extend the total life of tires, proper air pressure must be maintained at all times.

The average total life of front tires is much less than for the larger rear tires. For the 114 tractors reporting rubber tires, the average estimated life of front tires was 2.2 years as compared with 4.8 years for the rear tires (Table 12).

Front tires on large tractors had an average life of 1.8 years as compared with 2.5 years for those on medium tractors and 2.0 years for those on small tractors. Rear tires on large tractors had an average life of 4.8 years as compared with 5.0 on medium-sized tractors and 4.2 years on small tractors. Small tractors in the delta areas are frequently overloaded

TABLE 12. Estimated Average Life of Tractor Tires on 114 Tractors Used in the Mississippi River Delta Cotton Area, 1944

Wheel Type and Size of Tractor	Life of Tires (years)	
	Front	Back
Rubber tires		
Small	2.0	4.2
Medium	2.5	5.0
Large	1.8	4.8
All rubber	2.2	4.8

and are used for numerous odd jobs on terrain that is rough and not conducive to a long life for tires. Medium-sized tractors are used predominantly for field work, while large tractors are used both for field work and to a considerable extent in heavy operations in drainage, land clearing, and logging. Large tractors are also used more days during the year than small or medium-sized tractors.

Fuel, Oil and Grease Consumption—The fuel consumption of tractors is dependent upon several factors, namely the size of tractor, type of wheel, and the type of work that is being done (Table 13). Large-size tractors obviously consume more fuel per day or per hour than medium or small tractors. Tractors on steel require more fuel than those mounted on rubber. The fuel consumption for a given tractor also varies widely depending on the type of work to be done, however. For instance, a medium-sized tractor mounted on rubber usually required about 22.7 gallons of fuel per 10-hour day when used for heavy work (flatbreaking, discing, and bedding), 17.1 gallons when used for light work (planting, cultivating, and mowing), and 14.6 gallons when used for belt work. The average for all types of work is 19.8 gallons per 10-hour day.

Gasoline is generally used for starting purposes only. Unless specified, it is not generally used as the principal fuel. The price differential between gas and tractor fuel discourages the use of gas except where it is specified.

Oil consumption per 10-hour day does not vary greatly for different kinds of work but does vary considerably depending upon the size of tractor (Table 13).

The quantity of grease used per day depends upon the size of tractor and to a lesser extent upon whether the tractor is mounted on steel or rubber. It is difficult to determine the amount of grease used for tractors under practical farm conditions, as the same kind of grease is used for both the tractor and its complementary equipment.

TABLE 13. AVERAGE FUEL, OIL, AND GREASE CONSUMPTION PER 10-HOUR DAY FOR TRACTORS, CLASSIFIED BY SIZE OF TRACTOR AND TYPE OF WHEEL, FOR HEAVY AND LIGHT DRAWBAR WORK AND BELT WORK IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Size of Tractor, Type of Wheel, and Nature of Work	Average per 10-hour Day					
	Combination of Fuels			Gasoline Exclusively	Oil	Grease
	Gasoline	Fuel Oil	Total			
Small tractors:	gallons	gallons	gallons	gallons	quarts	pounds
Rubber tires						
Heavy work	1.0	17.7	18.7	15.4		
Light work	1.0	12.4	13.4	10.7		
Belt work	1.0	15.0	16.0	8.0		
Average	1.0	14.1	15.1	13.1	0.80	0.25
Steel wheels.						
Heavy work	1.0	22.0	23.0	14.0		
Light work	1.0	16.7	17.7	8.0		
Belt work	1.0	15.0	16.0	....		
Average	1.0	19.3	20.3	11.0	1.60	0.25
Medium tractors						
Rubber tires						
Heavy work	1.2	21.5	22.7	....		
Light work	1.1	16.0	17.1	....		
Belt work	1.0	13.6	14.6	....		
Average	1.1	18.7	19.8	....	1.80	0.36
Steel wheels						
Heavy work	1.3	22.0	23.3	....		
Light work	1.3	17.0	18.3	....		
Belt work	1.2	17.0	18.2	....		
Average	1.3	20.0	21.3	....	2.10	0.42
Large tractors:						
Rubber tires						
Heavy work	1.1	25.0	26.1	....		
Light work	1.1	18.0	19.1	....		
Belt work	1.0	19.5	20.5	....		
Average	1.1	22.1	23.2	....	2.10	0.34
Steel wheels						
Heavy work	1.4	27.0	28.4	....		
Light work	1.5	17.2	18.7	....		
Belt work	1.4	19.0	20.4	....		
Average	1.4	25.2	26.6	....	2.70	0.39

[1]Heavy work includes flatbreaking, discing, bedding, etc., and light work includes planting, cultivating, mowing hay, etc.

Utilization of Tractors

Since the annual amount of use that is made of tractors is one of the chief factors affecting the cost of operation, it is important to appraise the utilization of tractors throughout the year.

For all tractors the average number of 10-hour days used per year was 94.8, or 948 hours (Table 14). Tractors mounted on rubber were used more days during the year than those mounted on steel—103.6 days as compared with 78.5 days. Large tractors mounted on rubber were used more days per year than any other group of tractors.

TABLE 14. AVERAGE NUMBER OF 10-HOUR DAYS USED ANNUALLY ON AND OFF THE FARM FOR 179 TRACTORS, BY WHEEL TYPE AND SIZE OF TRACTOR IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Wheel Type and Size of Tractor	*10-hour Days Used*			
	On farm	*Custom work*	*Total days used*	*No. days of belt work*[1]
Rubber tires				
Small	91.6	3.4	95.0	....
Medium	96.0	2.0	98.0	2.8
Large	111.3	3.0	114.3	4.4
All rubber	101.1	2.5	103.6	3.0
Steel wheels				
Small	84.3	2.5	86.8	5.0
Medium	73.0	5.0	78.0	5.3
Large	74.5	3.5	78.0	2.2
All steel	74.0	4.5	78 5	4.7
All tractors				
Small	89.9	3.3	93.2	1.1
Medium	85.5	3.8	89.3	4.0
Large	103.1	3.2	106.3	3.9
All tractor	91.3	3.5	94.8	3.7

[1]Included in days used on the farm and for custom work.

Custom work affords many farm operators an opportunity to achieve fuller utilization of their tractors and tractor equipment. Very little custom work was performed by full-time farm operators in the delta cotton areas, as indicated in Table 14. For all tractors the average number of days used for custom work was only 3.5 days.

The average number of days that tractors were used for belt work is also included in Table 14. Tractor use for belt work is included in the number of days the tractor was used on the farm and for custom work. All tractors were used on an average of 3.7 days a year for belt work. Tractors mounted on steel were used more for belt work than those on rubber, 4.7 days a year as compared with 3.0 days.

TRACTOR USE THROUGHOUT THE YEAR—Most agricultural production, unlike industry, is seasonal in nature, and it is difficult for farmers to achieve full utilization of the factors of production throughout the year. Because of the variation in seasonal requirements for crop production, power and labor requirements are concentrated into relatively short periods during the growing and harvesting season. During late fall and

TABLE 15. DISTRIBUTION OF DAYS OF TRACTOR USE FOR TRACTORS, CLASSIFIED BY SIZE OF TRACTOR AND TYPE OF WHEEL, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Month	All tractors			Small tractors			Medium tractors			Large tractors		
	Total tractors	Rubber tires	Steel wheels	Total small	Rubber tires	Steel wheels	Total medium	Rubber tires	Steel wheels	Total large	Rubber tires	Steel wheels
	10-hour days											
January	1.9	2.1	1.5	1.7	1.7	1.5	1.7	1.8	1.5	2.5	2.8	1.5
February	3.3	3.5	2.8	2.8	2.7	3.2	2.7	2.6	2.8	4.5	5.0	2.6
March	10.8	11.6	9.3	9.6	9.5	9.7	10.4	11.2	9.3	12.0	12.9	9.0
April	13.4	14.8	10.9	13.2	13.6	12.0	12.9	14.4	11.1	14.5	15.9	9.5
May	12.7	13.8	10.5	15.1	15.2	15.0	12.4	13.7	10.7	12.4	13.6	8.3
June	12.9	14.0	10.8	14.4	14.9	12.5	12.5	13.6	11.2	13.0	14.2	8.5
July	10.0	10.9	8.4	11.4	11.5	11.2	9.2	10.3	7.7	11.1	11.3	10.4
August	8.8	9.9	6.9	8.3	8.7	6.8	7.8	9.0	6.4	11.0	11.4	9.4
September	7.1	7.5	6.3	6.4	6.2	7.3	6.5	7.0	5.8	8.4	8.5	7.9
October	5.9	6.7	4.4	6.3	7.1	3.3	5.1	5.6	4.4	7.4	8.1	5.1
November	5.6	6.1	4.8	3.2	2.9	4.0	5.6	5.9	5.1	6.6	7.4	3.8
December	2.4	2.7	1.9	0.8	1.0	0.3	2.5	2.9	2.0	2.9	3.2	2.0
Total	94.8	103.6	78.5	93.2	95.0	86.8	89.3	98.0	78.0	106.3	114.3	78.0

winter, power requirements in farming are small and as a consequence little use is made of tractors or other farm machinery because little field work is done during this period.

The distribution of tractor use throughout the year is presented by months in Table 15. The variation in tractor use throughout the year by size and wheel type is insignificant. However, tractors mounted on rubber are used more fully during the peak season than those on steel. Tractors on steel have usually been used relatively more in land preparation than in the cultivation of crops, mowing or combining. Rainfall and weather conditions during the growing season tend to limit the number of days that are suitable for field work for mechanical power more than when mules are used.

Because of the limited number of days suitable for field work, farmers should consider the possibilities of using their power unit at night during peak seasons. Only a few farmers were doing night work at the time of this survey, but this does provide a valuable means of meeting power requirements during the peak season of crop production. Also, the fuller utilization of power units tends to reduce the total cost of operation.

Tractor Use in Relation to Size of Farm—Tractors are used more fully during the peak season in April, May, and June on large farms with more than 300 acres in crops than on farms of less than 300 acres (Table 16). The total annual use on farms with more than 300 acres in crops was 111.9 days as compared with 91.4 days on farms with 150-299 acres in crops, 74.3 days on farms with 50-149 acres in crops, and only 57.2 days on farms of less than 50 acres in crops.

Tractors on small farms are underutilized during the peak season. On the basis of the usual number of days suitable for field work in the area during April, May, and June, it is estimated that these tractors are utilized at about 50 to 60 per cent of capacity. With this underutilized capacity small farmers have an opportunity to do custom work and obtain fuller utilization of their equipment, thus achieving lower costs of operation. As a rule small farmers are more receptive to custom work than large farmers.

Tractor Use for Different Kinds of Work—Farm tractors are used for many types of farm work and with various items of complementary equipment. The distribution of tractor use has been broken down as to the number of hours used annually for combining, baling hay, belt work, use not in conjunction with any equipment on the farm, and with all other complementary equipment—disc, harrow, planter, cultivator, carts, etc. (Table 17).

Tractors were used for custom work to a larger extent on small farms than on large farms. Hours used for combining, baling hay, and belt

TABLE 16. MONTHLY DISTRIBUTION OF DAYS OF TRACTOR USE PER TRACTOR ON FARMS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*All Farms*	*Size of Farm*[1]			
		Less than 50	*50-149*	*150-299*	*300 and over*
Number of farms[2]	95	16	27	27	25
Number of tractors	179	16	31	52	80
Average horsepower rating	25.13	20.34	24.25	25.18	26.08
Tractor cost per day[3]	$5.58	$6.75	$5.77	$5.48	$5.30
Month	*10-hour Days*				
January	1.9	1.4	1.7	1.4	2.3
February	3.3	3.3	3.0	2.1	4.1
March	10.8	8.1	8.4	9.9	12.8
April	13.4	8.8	11.2	13.1	15.3
May	12.7	8.6	10.2	12.3	14.6
June	12.9	8.1	10.8	13.1	14.4
July	10.0	5.4	6.5	10.0	12.3
August	8.8	2.5	6.5	9.1	10.8
September	7.1	2.6	5.0	7.4	8.5
October	5.9	3.3	5.1	5.3	7.1
November	5.6	4.3	4.3	5.5	6.4
December	2.4	0.8	1.6	2.2	3.3
Total	94.8	57.2	74.3	91.4	111.9

[1]Based on acres in crops.
[2]Number reporting tractors.
[3]Average cost of operating tractors per 10-hour day.

work were greater on the larger farms. The average number of tractors per farm is given, and the total hours of tractor use in combination with the complementary equipment is also computed, in Table 17.

COST AND UTILIZATION OF ANIMAL POWER

Workstock are still an important source of power on many delta farms. As a rule workstock are relatively more important on small farms and on large farms that are operated primarily by sharecroppers or share-renters.

In order to appraise the relative economies of mechanical and animal power systems, it was necessary to obtain detailed costs of keeping workstock as a source of power. Therefore, detailed information was obtained on the usual feeding practices, the useful life, and the annual use of workstock. The cost of keeping workstock was relatively high in 1944 primarily because of high feed prices.

The average cost of keeping a mule on all farms included in this

TABLE 17. UTILIZATION OF TRACTORS FOR DIFFERENT KINDS OF WORK, BY SIZE OF FARM, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*Size of Farm*[1]			
	Farms less than 50 acres	*50-149 acres*	*150-299 acres*	*300 acres and over*
Total hours of tractor work	572	743	914	1,119
Total hours of custom work	131	95	26	0
Average for eacn Tractor:				
Hours used for combining	4	29	43	54
Hours used for baling hay	3	23	26	32
Hours used for belt work	17	64	52	23
Hours tractor used alone[2]	35	12	..	2
Hours tractor used with other complementary equipment[3]	513	639	793	1,008
Average number of tractors on farm	1[4]	1.3	1.9	3.2
Total hours tractors used with other complementary equipment[3]	513	831	1,507	3,256

[1]Based on acres in crops.

[2]Usually custom work.

[3]Excluding tractor use for combining, hay baling, belt work, and use when the tractor only was rented out.

[4]Average for only those farms with tractor, 17 farms.

study was $198.55, excluding a credit for manure (Table 18). No credit was allowed for manure, as it was assumed this item would offset the cost of shelter in most instances. Feed costs accounted for $158.08, or nearly 80 per cent of the total costs.

Cost of Keeping Workstock in Relation to Size of Farm

The cost of keeping workstock was less on small farms than on large farms—$183.28 per head on all farms with less than 50 acres in crops as compared with $209.66 on farms with 150-299 acres in crops and $223.00 on farms with over 300 acres in crops. Better workstock are usually maintained on the large plantation units than on the small farms in the delta areas.

If the average annual cost of keeping workstock is divided by the average number of hours workstock were used during the year, the average cost per hour of use is obtained. On the farms included in this study the average cost per hour was 31 cents. The average cost per hour was lowest on the group of small farms and on the large farms with more than 300 acres in crops. Average costs were higher on medium-sized farms from 50 to 149 and 150-299 acres in crops.

TABLE 18. AVERAGE COST OF KEEPING WORKSTOCK PER HEAD AND COST PER HOUR OF USE ON FARMS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Item	Unit	Average all head		Size of farm (acres in crops)							
				Less than 50		50–149		150–299		300 and over	
		Amount	Cost	Amount	Cost	Amount	Cost	Amount	Cost	Amount	Cost
Feed costs:											
Corn	bu.	45.0	$ 65.25	60.3	$ 87.44	47.9	$ 69.49	28.3	$ 41.04	36.1	$ 52.35
Oats	bu.	38.5	38.50	5.1	5.10	21.0	21.00	73.9	73.90	72.9	72.90
Legume hay	ton	2.0	46.00	1.9	43.70	1.9	43.70	2.1	48.30	1.9	43.70
Non-legume hay	ton	0.1	1.80	....	.....	0.2	3.60	0.1	1.80	0.1	1.80
Salt	lbs.	40.8	.53	35.0	.46	44.0	.57	43.8	.57	43.6	.57
Pasture	mo.	6.0	6.00	6.7	6.70	6.1	6.10	6.0	6.00	5.0	5.00
Total		....	$158.08	....	$143.40	....	$144.46	....	$171.60	....	$176.32
Other costs:											
Depreciation[2]		....	$ 15.07	....	$ 11.80	....	$ 13.86	....	$ 15.67	....	$ 21.96
Interest[3]		....	5.31	....	4.53	....	4.78	....	5.29	....	7.22
Chore labor	hrs.	66	13.20	85	17.00	72	14.40	45	9.00	50	10.00
Harness		....	5.15	....	4.84	....	5.04	....	5.92	....	5.67
Miscellaneous		....	1.74	....	1.71	....	1.43	....	2.18	....	1.83
Total		....	$ 40.47	....	$ 39.88	....	$ 39.51	....	$ 38.06	....	$ 46.68
Total all costs[4]		....	$198.55	....	$183.28	....	$183.97	....	$209.66	....	$223.00
Average hours worked annually		640	.....	663	.....	546	.....	593	.....	766	.....
Average cost per hour worked		....	$ 0.31	....	$ 0.28	....	$ 0.34	....	$ 0.35	....	$ 0.29

[1]Prices used: corn, $1.45 per bushel; oats, $1.00 per bushel; legume hay, $23 per ton; non-legume hay, $18 per ton; salt, $1.30 per cwt.; pasture, $1 per month; chore labor, $0.20 per hour.

[2]Average estimated value of workstock when purchased, $177. Estimated years of useful life, 11.75.

[3]Interest calculated at 6 per cent of one-half the estimated value of workstock.

[4]The cost of shelter is not included. It is assumed that the value of manure is sufficient compensation for shelter.

Cost of Keeping Workstock in Relation to Number of Days Worked Annually

There is considerable variation in the cost of keeping workstock, depending upon the amount of annual use. As compared with the average cost of $198.55 for keeping workstock on all farms, the annual cost per head was only $162.97 when workstock were used less than 30 days or 300 hours a year, $178.75 when used from 30 to 59 days, $206.52 when used from 60 to 89 days, and $225.21 when used more than 90 days a year (Table 19).

If workstock are kept in good working condition and only partially utilized as a source of power, the cost per hour of use is very high—$1.17 per workstock hour for those worked only 139 hours annually. This compares with 44 cents an hour when workstock are used 410 hours annually, 27 cents when used 761 hours and 21 cents when used on an average of 1,055 hours during the year.

Utilization of Workstock

The annual amount of use that is made of workstock directly affects the cost per hour of use. Farm operations have been mechanized rapidly and workstock numbers have not been decreased materially as tractors have been added. Consequently, workstock are underutilized on all groups of farms that have been mechanized.

When workstock are used fully under non-mechanized conditions, they are used on an average more than 90 days a year or approximately 1,055 hours. The cost per workstock hour under these conditions was shown to be about 21 cents. Under conditions prevailing at the time of this survey, workstock were being used on an average of only 640 hours annually at a cost of 31 cents.

It was apparent that most farmers had made little attempt to reduce feed costs when workstock were being used at less than capacity. The principal reason for not reducing feed costs in proportion to the underutilization of workstock was that it was necessary to keep them in strong physical condition if they were to be used at all. Some farmers, however, were making reductions in daily rations, and workstock were being pastured to a greater extent.

Farmers estimated that purchase of one medium-sized tractor would provide sufficient power to replace 6 to 8 head of workstock, depending upon the type of work to be done—6 in light work and 8 for heavy work. However, most farmers have not reduced workstock immediately upon adoption of tractor power, and as a result power costs are higher than they should be.

If farmers are to achieve the economies afforded through the mechan-

TABLE 19. AVERAGE COST OF KEEPING WORKSTOCK PER HEAD AND COST PER HOUR OF USE FOR GROUPS OF WORKSTOCK CLASSIFIED BY NUMBER OF DAYS WORKED ANNUALLY IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Item	*Unit*	*Average all head*		*Size group (10-hour days worked per year)*							
				Less than 30		*30-59*		*60-89*		*90 and over*	
		Amount	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*
Feed Costs:											
Corn	bu.	45.0	$ 65.25	33.9	$ 49.16	42.9	$ 62.21	46.5	$ 67.43	52.3	$ 75.84
Oats	bu.	38.5	38.50	28.1	28.10	28.2	28.20	41.6	41.60	50.9	50.90
Legume hay	ton	2.0	46.00	1.9	43.70	1.7	39.10	2.0	46.00	2.2	50.60
Non-legume hay	ton	0.1	1.80	0.1	1.80	0.2	3.60	0.1	1.80	....	.....
Salt	lbs.	40.8	.53	41.4	.54	35.4	.46	41.6	.54	43.4	.56
Pasture	mo.	6.0	6.00	8.4	8.40	5.9	5.90	6.1	6.10	4.1	4.10
Total		....	$158.08	....	$131.70	....	$139.47	....	$163.47	....	$182.00
Other Costs:											
Depreciation[2]		....	$ 15.07	....	$ 11.77	....	$ 13.63	....	$ 16.86	....	$ 15.80
Interest[3]		....	5.31	....	4.54	....	4.88	....	5.61	....	5.50
Chore labor	hrs.	66	13.20	44	8.80	71	14.20	70	14.00	69	13.80
Harness		....	5.15	....	5.11	....	5.03	....	5.16	....	5.27
Miscellaneous		....	1.74	....	1.05	....	1.54	....	1.42	....	2.84
Total		....	$ 40.47	....	$ 31.27	....	$ 39.28	....	$ 43.05	....	$ 43.21
Total all costs[4]		....	$198.55	....	$162.97	....	$178.75	....	$206.52	....	$225.21
Average hours worked annually		640	.....	139	.....	410	.....	761	.....	1055	.....
Average cost per hour worked		....	$ 0.31	....	$ 1.17	....	$ 0.44	....	$ 0.27	....	$ 0.21

[1]Prices used: corn, $1.45 per bushel; oats, $1.00 per bushel; legume hay, $23 per ton; non-legume hay, $18 per ton; salt, $1.30 per cwt.; pasture, $1.00 per month; chore labor, $0.20 per hour.

[2]Average estimated value of workstock when purchased, $177. Estimated years useful life, 11.75.

[3]Interest calculated at 6 per cent of one-half the estimated value of workstock.

[4]The cost of shelter is not included. It is assumed that the value of manure is sufficient compensation for shelter.

ization of farm operations, workstock numbers must be drastically reduced. Economy-conscious operators cooperating in this study of 120 farms have demonstrated that it is feasible to substitute a medium-sized tractor for 6 mules without impairing effectiveness in the performance of farming operations.

COST AND UTILIZATION OF COMPLEMENTARY TRACTOR AND WORKSTOCK EQUIPMENT

The mechanization of farm operations has resulted in greater capital requirements for equipment. In addition to the consideration of power costs, it is necessary to evaluate the cost of operating complementary equipment that is used in conjunction with the power unit. In order to compare the economy of mechanized versus non-mechanized methods of farming, equipment costs deserve careful analysis.

The materials presented in this bulletin on the cost and utilization of complementary tractor equipment are divided into three parts: (1) cost and utilization of tractor and workstock equipment, exclusive of specialized machines such as combines and hay balers, (2) cost and utilization of combines, and (3) cost and utilization of hay balers. All mule equipment is grouped together and analyzed as a unit.

Costs of operating various farm implements vary widely. Individual variations in the cost of repairs and depreciation for different farm implements are related to the amount of use that is made of them, the care in operation, and the general physical features of the terrain. From the practical consideration of farming, however, it may be assumed that certain items of field equipment even though used very little during the year are as important as those that are used frequently throughout the year. In other words, planting equipment that is used only in one operation is just as essential to crop production as a cultivator or disc that is used much more frequently. For this reason, as well as for the sake of simplification, all field machinery costs except for the specialized machines are grouped together.

Cost and Utilization of Equipment[4]

Where mechanical power has been adopted, both tractor and workstock equipment are usually found. In the determination of costs, tractor and workstock equipment have been segregated. As progress is made toward complete mechanization, the relative importance of workstock equipment is expected to decline.

Tractor Equipment[5]—The average investment in tractor equipment

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[4] Exclusive of combines and hay balers, which are handled separately in this section.

[5] See Appendix Table 1 for supplementary information on average purchase price, depreciation, repairs, and interest for individual items of equipment.

TABLE 20. AVERAGE INVESTMENT IN TRACTOR AND WORKSTOCK EQUIPMENT, COSTS PER FARM, PER ACRE, AND PER HOUR OF USE ON FARMS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	All farms		Less than 50 acres cropland			50-149 acres cropland		150-299 acres cropland		300 acres cropland and over	
			Mule farms	Tractor farms							
	Tractor equipment[1]	Mule equipment	Mule equipment	Tractor equipment[1]	Mule equipment	Tractor equipment[1]	Mule equipment	Tractor equipment[1]	Mule equipment	Tractor equipment[1]	Mule equipment
	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars
Investment:											
Per farm	1,418	739	366	444	172	943	406	1,322	799	2,657	1,772
Per acre cropland	6.29	3.28	11.40	10.42	4.04	9.35	4.02	5.30	3.20	4.17	2.78
Annual equipment cost per farm:											
Repairs	109	35	27	33	10	60	23	104	42	215	63
Depreciation	137	62	25	39	15	84	30	126	69	271	157
Interest	43	22	11	13	5	28	12	40	24	80	53
Total	289	119	63	85	30	172	65	270	135	566	273
Total cost per acre of cropland[2]	1.28	0.53	1.96	2.00	0.70	1.70	0.64	1.08	0.54	0.88	0.43
Total hours of use per farm	1560	4480	2011	513	493	831	1638	1507	4507	3256	14,477
Average cost per hour of use	$ .185	$ .027	$ .031	$ .166	$ .061	$ .207	$ .040	$ .179	$ .030	$ .174	$ .019

[1]Excludes tractors, hay balers, and combines.

[2]For average acreage of cropland by size groups, see Table 3.

per farm, exclusive of combines and hay balers, ranged from $444 on small farms with less than 50 acres in crops to $2,657 on farms with more than 300 acres. The investment in tractor equipment per acre of cropland is less on the larger farms, however, than on small farms—$4.17 an acre on farms with more than 300 acres in crops and $10.42 on farms with less than 50 acres.

Annual equipment costs consist of repairs, depreciation, and interest on investment. The average annual cost of operating tractor-drawn equipment was $289 for all tractor farms (Table 20). The annual cost ranged from $85 on farms with less than 50 acres in crops to $566 on farms with more than 300 acres.

Per acre costs of equipment, however, were less on large farms than on small farms. The annual equipment costs per acre ranged from $0.88 on farms with more than 300 acres in crops to $2.00 on farms with less than 50 acres (Table 20).

If the annual cost of operating farm equipment is divided by the total number of hours that the equipment was used, the average cost per hour of use is obtained. The average cost per hour of use was 18.5 cents for all tractor farms. Farms with 50-149 acres in crops had the highest equipment cost per hour. These farms are usually fully equipped. The cost per hour of use was least on small farms. Usually, only the essential items of equipment for land preparation, planting, and cultivation are found on farms with less than 50 acres in crops and they are more fully utilized than on those farms that are slightly larger and more fully equipped. Fuller utilization of equipment on the larger farms of course results in lower costs of operation per hour of use.

Workstock Equipment—Workstock equipment is still found on most all farms, even on those where operations have become highly mechanized. With the shift from non-mechanized to mechanized power systems, however, much of this equipment is only partially used and frequently it is not used at all.

The average investment in mule equipment per farm, by size groups, is given in Table 20. It is difficult to determine values of this equipment on highly mechanized farms, as much of it is obsolete and not used to any great extent. The variation in investment per acre is due both to the influence of the size of farm and to the degree to which farming operations have been mechanized.

Annual costs of operation, as for tractor equipment, consist of annual repairs, depreciation, and interest. Wide variations in the relative importance of depreciation and repairs exist among farms and are usually

related to the principal type of power used on the farm, the extent of equipment use, and the care that is taken of the equipment itself.

The average cost per hour of use on all farms was 2.7 cents as compared with 3.1 cents on small farms operated entirely with mules and 1.9 cents on farms with more than 300 acres in crops. The highest cost of operating mule equipment was 6.1 cents an hour, and that was on small farms where mechanical power systems had been adopted.

Utilization of Equipment—The use that is made of equipment varies greatly from farm to farm depending primarily upon equipment inventories in relation to acres of cropland operated. The shift from animal to mechanical power systems has proceeded so rapidly in this area that all farms have greater inventories than are required to perform the usual operations. Excessive inventories are generally due to surplus workstock equipment.

The total hours that the complementary tractor and workstock equipment were used on the farms surveyed are included in Table 20. The variations in use due to size of farm and type of power system may be observed.

Cost and Utilization of Combines

The combines presently in use on delta farms are about evenly divided between those with the power take-off and with the auxiliary motor. The annual cost of operating combines per year was greater for those with the auxiliary motor, $232.49 as compared with $171.45 for those with the power take-off. The acreage harvested per machine was greater for combines with the auxiliary motor, 119 acres as compared with 99 (Table 21).

The average cost of operating combines with an auxiliary motor was $1.95 an acre as compared with $1.73 an acre for those with the power take-off (Table 21). The cost of operating combines with an auxiliary motor exceeds that of operating those with the power take-off by 22 cents an acre. This differential is about equal to the operating costs for fuel and oil.

Depreciation is the chief item of cost, amounting to more than one-half of the total. The cost of repairs and upkeep is second in importance and interest on investment is third.

The average age of combines with the power take-off was greater than those with a motor, 4.5 years as compared with 2.7 years (Table 22). The estimated total useful life was about the same for both types of combines. Combines with the auxiliary motor recently have gained popularity and are generally preferred to those with the power take-off, mainly because they are more effective in harvesting crops. The efficiencies gained more

TABLE 21. AVERAGE COST PER YEAR AND PER ACRE OF OPERATING SIXTY-ONE 60-INCH COMBINES, BY TYPE OF POWER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Combines with			
	Power take-off[1]		Auxiliary motor[1]	
	Cost per year	Cost per acre	Cost per year	Cost per acre
	dollars	dollars	dollars	dollars
Repairs and upkeep[2]	49.83	.50	43.39	.36
Depreciation[3]	97.14	.98	130.23	1.09
Interest[4]	24.48	.25	33.60	.28
Operating costs[5]	.....	....	25.27	.21
Total[6]	171.45	1.73	232.49	1.95
Acreage harvested per combine	99		119	

[1]Thirty-one combines with power take-off; thirty combines with auxiliary motor.

[2]Average of farmers' estimates of the annual repair and upkeep costs.

[3]The average purchase price for combines with the power take-off was $816 and the estimated useful life 8.4 years; the average purchase price for combines with the auxiliary motor was $1,120 and the estimated useful life was 8.6 years.

[4]Interest charged at 6 per cent on one-half of the average purchase price.

[5]Operating cost for auxiliary motor includes the charge for fuel and oil.

[6]Does not include a charge for taxes, shelter, or labor for operating the machine.

TABLE 22. AVERAGE AGE, ESTIMATED YEARS OF USE LEFT, AND THE EXPECTED TOTAL LIFE OF SIXTY-ONE 60-INCH COMBINES, BY TYPE OF POWER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Combines with	
	Power take-off	Auxiliary motor
	years	years
Average age	4.5	2.7
Estimated use left	3.9	5.9
Total useful life	8.4	8.6
Number of combines	31	30

than offset the additional cost of operation, according to the farmers interviewed.

The average acreage of crops harvested per combine is given in Table 23. Oats were by far the most important crop combined in the area. Other important crops that were harvested with a combine are soybeans, Singletary peas, and clover seed in that order.

TABLE 23. AVERAGE ACREAGE OF CROPS HARVESTED PER COMBINE IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Crop	Combine with		Average all combines
	Power take-off	Auxiliary motor	
	acres	acres	acres
Oats	79	89	84
Soybeans	15	23	19
Singletary peas	4	6	5
Clover	1	1	1
Total	99	119	109

Cost and Utilization of Hay Balers

There are three principal types of hay balers on delta farms: stationary tractor-powered balers, stationary balers with auxiliary motors, and pick-up balers. The pick-up balers in 1944 were operated with three men, but the general preference is for the adoption of one-man pick-up balers.

The annual cost of operating pick-up balers is higher than for the stationary balers, $183.22 as compared with $33.69 for stationary tractor-powered balers and $69.65 for stationary balers with an auxiliary motor (Table 24).

TABLE 24. AVERAGE ANNUAL COST AND COST PER ACRE OF OPERATING HAY BALERS, BY TYPE OF BALER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Stationary with				Pick-up balers[1]	
	Tractor power[1]		Auxiliary motor[1]			
	Annual cost	Cost per acre	Annual cost	Cost per acre	Annual cost	Cost per acre
	dollars	dollars	dollars	dollars	dollars	dollars
Repairs and upkeep[2]	8.00	.08	10.75	.10	28.08	.17
Depreciation[3]	17.68	.18	29.44	.29	104.56	.64
Interest[4]	8.01	.08	14.13	.14	31.68	.19
Operating costs[5]	.....	.....	15.33	.15	18.90	.12
Total[6]	33.69	.34	69.65	.68	183.22	1.12
Acreage per baler	97		102		164	

[1]Five stationary balers operated with tractor power; twenty-one stationary balers with an auxiliary motor; and twelve pick-up balers.

[2]Average of farmers' estimates of the annual repair and upkeep costs.

[3]The average purchase price for stationary balers without auxiliary motors was $267 and the estimated useful life 15 years; the average purchase price for stationary balers with an auxiliary motor was $471 and the estimated useful life was 16 years; and the average purchase price for pick-up balers was $1,056 and the estimated useful life was 10.1 years.

[4]Interest charged at 6 per cent on one-half of the average purchase price.

[5]Operating costs for auxiliary motor includes the charge for fuel and oil.

[6]Does not include a charge for taxes, shelter, or labor for operating the machine.

Acreage harvested per baler is considerably larger for pick-up balers. Per-acre cost of operating pick-up balers is also higher, $1.12 as compared with $0.34 for stationary tractor-powered balers and $0.68 for balers with an auxiliary motor. The increased efficiency of pick-up balers, due primarily to reductions in labor required for the haying operation, more than offsets the higher machinery cost per acre, however.

The trend has been toward the adoption of larger and more efficient balers. This is evidenced by the average age of balers now in use (Table 25). The average age of stationary tractor-powered balers was 9.2 years,

TABLE 25. AVERAGE AGE, ESTIMATED YEARS OF USE LEFT, AND EXPECTED TOTAL LIFE OF 38 HAY BALERS, BY TYPE OF BALER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Type of Baler		
	Stationary		Pick-up balers
	Tractor power	Auxiliary motor	
	years	years	years
Average age	9.2	4.6	1.7
Estimated use left	5.9	11.4	8.4
Total useful life	15.1	16.0	10.1
Number of balers	5	21	12

stationary balers with an auxiliary motor 4.6 years, and pick-up balers 1.7 years. The estimated life of pick-up balers is only about two-thirds that of stationary balers and accounts for higher annual depreciation costs.

Lespedeza was the principal hay crop in the delta, followed by alfalfa, Johnson grass, and other miscellaneous native grasses (Table 26). The

TABLE 26. AVERAGE ACREAGE OF HAY CROPS HARVESTED, BY CROP AND TYPE OF BALER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Crop	Stationary Balers		Pick-up balers	Average all balers
	Tractor power	Auxiliary motor		
	acres	acres	acres	acres
Lespedeza	88	79	103	88
Alfalfa	4	17	38	23
Johnson grass	0	4	23	10
Other hay	5	2	0	2
Total	97	102	164	123

average acreage harvested per baler was 123 acres, and ranged from 97 acres harvested per baler for stationary tractor-powered balers to 164 acres for pick-up balers.

RATES OF PERFORMANCE WITH TRACTORS AND WORKSTOCK

Increased efficiency in the utilization of labor is one of the most important aspects of the substitution of mechanical for animal power. Detailed information was obtained on practices and usual operations employed in producing the major crops in the area, including the usual rates of performing each operation. In actual practice rates vary with the size of power unit, size and condition of implement used, nature of the soil, and other factors. Efficiency can be gained by using the proper sized equipment with either tractors or mules.

Accomplishments with Tractor Power

The usual rates of performing the various field operations with tractors are presented in Table 27. Since the size of implement used is almost

TABLE 27. USUAL RATES OF PERFORMING THE VARIOUS OPERATIONS WITH TRACTORS IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Operations	*Size implement*	*Acres per 10-hr. day*	*Hours per acre*	
			Man	*Tractor*
Cutting stalks	2 row	22.2	0.45	0.45
Flatbreaking	2 pan	5.2	1.92	1.92
Flatbreaking	3 pan	7.3	1.37	1.37
Disking	6 feet	17.0	0.59	0.59
Harrowing(section)	8-12 feet	26.6	0.38	0.38
Breaking, middlebuster	2 row	14.8	0.68	0.68
Breaking, middlebuster	4 row	27.3	0.37	0.37
Rebreaking, middlebuster	2 row	15.4	0.65	0.65
Planting	2 row	17.6	0.57	0.57
Planting	4 row	41.7	0.24	0.24
Cultivating, 1st. and 2nd. time	2 row	12.7	0.79	0.79
Cultivating, other times	2 row	18.4	0.54	0.54
Cultivating, 1st. and 2nd. time	4 row	20.8	0.48	0.48
Cultivating, other times	4 row	37.5	0.27	0.27
Seeding oats, grain drill	8-10 feet	22.7	0.44	0.44
Seeding oats, grain drill	12-14 feet	28.2	0.35	0.35
Seeding oats, endgate seeder	.....	42.6	0.23	0.23
Fertilizing oats, drill	8-10 feet	23.8	0.42	0.42
Fertilizing oats, endgate seeder	.....	52.5	0.38	0.19
Combining oats	60 inch	12.8	1.56	0.78
Combining soybeans	42 inch.	7.7	2.60	1.30
Combining soybeans	60 inch	10.1	1.98	0.99
Mowing hay	7 feet	17.4	0.57	0.57
Raking hay (side delivery)	10 feet	20.8	0.48	0.48
Raking hay (dump)	10 feet	18.0	1.10	0.55

[1]Rates based on accomplishments of medium-sized tractors. Accomplishments for row crop operations based upon a standard 42-inch row.

directly related to accomplishment, rates were established for equipment of different sizes. It is also true that size of tractor is associated with variation in rates of performance. Large tractors are usually used when the large-sized implements are used and medium or small tractors are used with the smaller sized implements. In addition to the size and condition of implement used and the size of the power unit, other factors such as nature of the soil, and size and shape of the field affect the rates of performing farm jobs. These rates are averages and this should be considered in their interpretation.

The usual rates of performance are presented in terms of the average acreage covered in a 10-hour day. They are also presented in terms of man labor and power requirements per acre for performing each operation.

These data can be used for calculating labor and power requirements for any given crop. The practices and operations, including the number of times over, should be listed in sequence, and the time required for each job in hours per acre applied. An approximation of the requirements per acre will result from this method.

Accomplishments with Workstock Power

The usual rates of performing farm operations with workstock are presented in Table 28. The number of workstock used in the perform-

TABLE 28. Usual Rates of Performing the Various Operations with Workstock in the Mississippi River Delta Cotton Area[1]

Operation	*Number of mules*	*Acres per 10-hr. day*	*Hours per acre*	
			Man	*Mule*
Cutting stalks	2	7.0	1.4	2.8
Flatbreaking	2	1.6	5.9	11.8
Disking	2	5.5	1.8	3.6
Harrowing (section harrow)	2	11.6	0.9	1.8
Harrowing beds	1	6.7	1.5	1.5
Bedding (two furrows)	2	3.0	3.3	6.6
Bedding (two furrows)	1	2.8	3.6	3.6
Bedding (middlebuster)	2	6.0	1.7	3.4
Planting, 1 row	1	7.1	1.4	1.4
Planting, 1 row	2	7.6	1.3	2.6
Planting, 2 rows	2	14.8	0.7	1.4
Cultivating, 1st. and 2nd. time	2	5.6	1.8	3.6
Cultivating, 1st. and 2nd. time	1	3.0	3.3	3.3
Cultivating, other times over	2	6.7	1.5	3.0
Cultivating, other times over	1	3.3	3.0	3.0
Seeding oats, grain drill (8 qt.)	3	12.0	0.8	2.4
Seeding oats, endgate seeder	3	23.6	0.4	1.2
Mowing hay (4.5 ft.)	2	6.3	1.6	3.2
Raking hay (8 ft. dump)	2	14.3	0.7	1.4

[1]Accomplishments for row crop operations based upon a standard 42-inch row.

ance of a particular operation usually varies directly with the size of the implement. In other words, two mules are used with a double-breaking plow and one mule is used with a single-breaking plow. Two mules are required to operate a one-row cultivator and one mule is required with one-half-row cultivators.

In the delta areas one-row equipment or two-mule teams are typical when non-mechanized methods are employed. One-half-row operations are still employed on extremely small operating units and in the new ground areas, however.

The rates of performing farm jobs are presented in terms of the average acreage covered in a 10-hour day. As for tractor power, they are also given in terms of man labor and workstock requirements per acre for performing each operation. These data may be used for calculating man labor and workstock requirements for any given crop.

MAN LABOR AND POWER REQUIREMENTS IN CROP PRODUCTION UNDER MECHANIZED AND NON-MECHANIZED METHODS

The utilization of labor and power throughout the year is of great importance to the effective utilization of farm resources. Both total requirements and the distribution of these requirements are dependent upon the crop and livestock organization of farming systems, however. Certain crops and kinds of livestock that have extremely high labor requirements during certain seasons of the year make it difficult to obtain an even distribution of labor or power during the year. In order to obtain effective use of labor and power resources it is necessary that the farm organization provide farm work throughout most of the year. The type of power used in crop production is an important factor affecting the distribution and utilization of labor, power, and equipment on delta farms.

Distribution of Man Labor

The distribution of man labor in crop production is important in determining the amount of labor that is necessary to operate the farm. Both the total labor requirements and the distribution of labor are related to and are somewhat dependent upon the power system employed by farmers.

Mechanized Methods—Many farms in the area are completely mechanized with the exception of cotton and corn harvesting. The distribution of man labor when production is mechanized has been summarized for the more important crops in Table 29. When harvesting operations for cotton and corn are mechanized, further downward adjustments in

TABLE 29. USUAL DISTRIBUTION OF MAN LABOR REQUIRED IN CROP PRODUCTION, PER ACRE, UNDER MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	Crop								
	Cotton[2]	Corn[3]	Oats	Soybeans for beans	Lespedeza[4]	Soybeans for hay[4]	Alfalfa		Winter legumes
							Stationary baler	Pick-up baler	
	Hours of Man Labor								
January	4.1	.1	...	...	...	...	...	...	...
February	.1	.2	.2	.2	.4	...	...	...	...
March	.6	1.4	.2	1.2	.6	1.0	...	...	...
April	2.3	3.5	...	1.7	...	1.0	4.1	2.3	...
May	14.4	4.4	1.0	1.2	.3	1.0	9.5	5.5	...
June	14.1	1.8	1.6	.5	.3	.5	9.5	5.5	...
July	7.2	.2	.2	.1	2.1	...	4.1	2.3	...
August	9.1	...	.9	...	4.3	5.0	.8	.8	...
September	31.5	.4	1.7	.1	.7	3.0	1.6	1.6	.7
October	31.6	2.4	.56	1.4	...	1.0	2.0	2.0	.8
November	26.5	4.1	.04	1.2	...	...	...	...	1.2
December	9.2	1.2	...	...	.1	...	...	...	.6
Total per acre	150.7	19.7	6.4	7.7	8.7	12.5	31.6	20.0	3.3

[1]Crop yields are as follows: cotton, 578 lbs. of lint; corn, 26.9 bushels; oats, 40.2 bushels; soybeans for beans, 19.1 bushels; lespedeza, 1 ton; soybeans for hay, 1.5 ton; alfalfa, 3.9 tons.

[2]Hand labor for hoeing and picking.

[3]Hand harvesting.

[4]Baled with tractor and stationary baler.

total labor requirements, as well as more even distribution, are anticipated. At the present stage of mechanization serious labor peaks are encountered during the harvesting season. The reduction in labor required during the growing season means that less labor is needed then, than before farming was mechanized, but the harvesting peak is relatively more severe.

NON-MECHANIZED METHODS—Although most commercial farms have shifted to mechanical power systems, many farms are yet non-mechanized. Total labor required as well as the distribution of labor requirements throughout the year under non-mechanized methods are presented for principal crops in Table 30. Labor requirements are larger where operations are non-mechanized and two peak periods occur in crop production—the growing season and the harvesting season. Since most non-mechanized farms must keep sufficient labor on the farm during the growing season to produce the crops, the peak requirements during the harvesting season are not so severe as on mechanized farms.

Distribution of Tractor Requirements

In order to appraise the utilization and adequacy of power on an individual farm, it is necessary to have data on the total power required

TABLE 30. USUAL DISTRIBUTION OF MAN LABOR REQUIRED IN CROP PRODUCTION, PER ACRE, UNDER NON-MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	Crop						
	Cotton	Corn	Oats	Lespedeza[2]	Soybeans for hay[2]	Alfalfa[2]	Winter legumes
	Hours of man labor						
January	.1	.5	....	....	....	....	....
February	.6	1.6	.03	.2	....	....	....
March	4.6	5.3	.27	.8	2.7	....	....
April	5.6	6.4	....	....	1.9	....	....
May	17.5	7.3	1.0	.4	2.3	7.8	....
June	20.3	2.5	2.4	.5	1.5	7.6	....
July	6.7	.6	....	2.7	....	6.7	....
August	12.3	....	1.9	5.6	5.1	3.4	....
September	34.1	....	4.1	.9	2.9	7.1	.7
October	34.1	2.0	2.3	....	.8	1.1	1.3
November	27.9	5.4	.2	....	....	....	1.3
December	5.3	1.2	....	....	....	....	.7
Total	169.1	32.8	12.2	11.1	17.2	33.7	4.0

[1]Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

[2]Hay handled loose.

TABLE 31. USUAL DISTRIBUTION OF TRACTOR POWER REQUIRED IN CROP PRODUCTION, PER ACRE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	Crop								
	Cotton	Corn	Oats	Lespedeza	Soybeans for beans	Soybeans for hay	Alfalfa		Winter legumes
							Stationary baler	Pick-up baler	
	Hours of tractor work								
January	...	.1	...	...	...	...	...	...	...
February	.1	.2	.1	...	.2	...	...	...	...
March	.6	1.4	.1	...	1.2	1.0	...	...	...
April	2.3	1.6	...	...	1.7	1.0	1.3	.9	...
May	2.4	1.2	.3	.3	1.2	1.0	3.1	2.3	...
June	2.1	.5	.5	.3	.5	.5	3.0	2.2	...
July	1.2	.3	.2	.7	.1	...	1.3	.9	...
August	...	...	.9	1.3	...	1.0	.8	.8	...
September	...	...	1.7	.2	.05	.5	1.3	1.3	...
October	...	...	.56	...	.5	.2	1.3	1.3	.4
November	...	...	.04	...	.4	...	...	...	.6
December	...	...	...	...	.05	...	...	...	.3
Total	8.7	5.3	4.4	2.8	5.9	5.2	12.1	9.7	1.3

[1]Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

as well as the distribution of these requirements throughout the year. The data on tractor hour requirements and distribution of these requirements are presented in Table 31. From these data it is possible to determine the maximum acreage a given power unit will handle under normal weather and working conditions.

Distribution of Workstock Requirements

Just as in the case of tractor power, total mule work required and the distribution of mule work during the year determine the maximum acreage that a given number of mules can handle. Mule power requirements and the distribution of these requirements are presented in Table 32. Peak requirements occur during the planting and growing season and last for about 3 months. Requirements are relatively small during the rest of the year.

PROBLEM OF REDUCING POWER AND EQUIPMENT COSTS

The delta cotton areas are in the midst of shifting from animal to mechanical power systems. Farmers seldom make the shift to complete mechanization at one time. In other words, mechanization usually progresses by stages. Preparation of land is usually the first operation that is mechanized. The extent to which various operations have been mechanized is presented in Table 33. On the farms surveyed more than 80 per cent of all land preparation in 1944 was done with mechanical power. About one-half of the cotton and corn acreage was cultivated with mechanical power. Approximately two-thirds of the soybean crop was cultivated with tractors. However, no adjustment was made for the abandonment of this crop. Abandonment runs high in the soybean enterprise as the crop is usually planted on back land or weed infested fields. At the time of this survey no mechanical cotton harvesting was practiced. Corn pickers were used only on an experimental basis. Practically all oats and soybeans were harvested with combines pulled by tractors, however.

Because of this transitory condition resulting from the shift from animal to mechanical power systems, high power and equipment costs are to be expected. Adjustments are being made gradually which will tend to reduce these costs of farming. The indivisibility of the farmer's resources will continue in agriculture and will doubtless retard the attainment of minimum power and equipment costs.

Farmers are not doing a good job of protecting their equipment from the natural forces of weather. The degree to which the farmers included in this survey were attempting to provide shelter for their machinery, when it was not in use, is summarized in Table 34.

Nearly three-fourths of all farmers reporting tractors were making an effort to provide shelter for them. Less than half of the tractors on farms under 50 acres were housed when not in use.

TABLE 32. USUAL DISTRIBUTION OF HOURS OF MULE WORK REQUIRED PER ACRE IN CROP PRODUCTION UNDER NON-MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	Crop							
	Cotton	Corn	Oats	Lespedeza	Soybeans for hay	Alfalfa	Other crops	Winter legumes
	Hours of mule work							
January	.2	1.1	....	....	....	....	....	....
February	1.2	3.2	.1	....	.8	....	....	....
March	9.2	10.0	.8	....	4.2	....	2.0	....
April	11.2	8.5	.5	....	2.0	....	4.0	....
May	11.0	7.6	1.1	.7	3.0	5.0	4.0	....
June	10.6	2.6	3.8	1.2	1.0	5.0	4.0	....
July	7.4	1.3	8.5	2.8	....	5.0	3.0	....
August	.6	....	5.0	5.8	5.0	2.5	3.0	....
September	2.2	....	.5	.9	3.0	5.0	2.0	1.0
October	2.2	1.4	....	....	1.0	.5	2.0	2.0
November	1.8	4.3	....	....	....	....	....	2.0
December	.6	.8	....	....	....	....	....	1.0
Total	58.2	40.8	20.3	11.4	20.0	23.0	24.0	6.0

[1]Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

TABLE 33. EXTENT TO WHICH FARM OPERATIONS WERE MECHANIZED IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Operations	Selected crops			
	Cotton	Corn	Oats	Soybeans for beans
	Per cent mechanical power used			
Land preparation	85	81	95	83
Cultivation	49	55	..	67[1]
Harvesting	0	4	89[1]	61[1]

[1]No correction was made for abandonment. In the case of soybeans considerable abandonment is common. Some oats are cut for hay on non-mechanized units. Nearly 100 per cent of the oats and soybeans harvested were combined.

Only 55 per cent of the farmers reporting indicated that other farm machinery was kept under shelter when it was not in use. Large farm operators were more likely to provide shelter than small farmers.

An inquiry was made to determine whether a special machinery shed was maintained on the farm. Only 55 per cent reported that special

TABLE 34. Degree to which Tractors and Farm Equipment were being Housed, by Size of Farm, in the Mississippi River Delta Cotton Area, 1944[1]

Size of farm[2]	Was tractor housed when not used?			Was other machinery housed when not used?			Is there a special machinery shed on farm?		
	No. reporting	Per cent		No. reporting	Per cent		No. reporting	Per cent	
		Yes	No		Yes	No		Yes	No
Less than 50 acres	16	44	56	24	42	58	24	33	67
50-149 acres	22	82	18	23	61	39	24	54	46
150-299 acres	25	76	24	24	50	50	23	52	48
300 acres and over	22	77	23	22	68	32	22	82	22
Average all groups	85	72	28	93	55	45	93	55	45

[1]Based on the practice of farmers reporting.
[2]Based on acres of cropland.

facilities were maintained for the storage of farm machinery. A higher proportion of large farm operators reported special machinery sheds than did the small farmers—82 per cent of farms with more than 300 acres of cropland as compared with only 33 per cent of farms with less than 50 acres.

On the basis of performance, then, slightly over one-half of the farmers reporting in this survey were attempting to protect their machinery from the weather. This of course is only an indication of the extent to which farmers are conscious of the value of proper equipment care. Undoubtedly the length of useful life could be extended, and consequently the cost of depreciation and repairs reduced, if shelter were provided when the equipment was not in use. Sufficient data are not readily available to evaluate the economies achieved through the protection of machinery by providing proper housing. However, many farmers who are not now protecting their machinery from the weather could do so at nominal cost, either through the conversion of old buildings now on the farm or the construction of simple low-cost machinery sheds.

Things Farmers May Do to Reduce Power and Equipment Costs

Many opportunities exist on farms in the delta cotton areas for sizable reductions in the cost of power and equipment. Some of the more important means of effecting economies in the cost of power and equipment are enumerated as follows:

1. When tractors are adopted as the power unit, reduce workstock numbers to the absolute minimum as soon as possible. On small farms with less than 100 crop acres, one tractor is sufficient power, and workstock can be eliminated. In other instances there may be reasons why one team is necessary for the successful operation of the farm.

2. Increased annual use of the power unit and the complementary equipment is the most effective means of reducing the costs of operation.

Where the power unit and equipment are not used to capacity, plan to work for other farms on a custom basis. Custom work affords an opportunity for the small farmer to obtain fuller utilization of the power unit, and at the same time, it provides employment opportunities for the farmer's labor. Even though it may be necessary to hire labor for certain farm work, the skilled tractor operator stands to gain by doing custom work because he is able to obtain fuller utilization of his power and equipment and at the same time earn wages commensurate with his abilities. On a 40-acre farm, the power unit is used less than 50 per cent of capacity. This means that sufficient power and equipment are available to operate at least another 40-acre farm of similar organization.

3. If the possibility of doing custom work is poor, rent or buy additional farm land if it is available. This is a desirable means of expanding the farm business and could achieve better utilization of labor through diversification of crop and livestock enterprises as well as more complete utilization of power and equipment. Farmers should exercise care in buying additional farm land during periods of high prices. If care is not taken, many farmers may find that the mortgage they give in periods of high prices exceeds the long-run normal agricultural value of the land—not to mention the down payment, which currently ranges from 25 to 50 per cent.

4. If custom work does not prove a satisfactory arrangement and renting or buying additional land is impracticable, explore the possibilities of cooperative ownership and use of the power unit. Two or three small farm operators may find it profitable to own a tractor and the equipment together. When the power system is owned cooperatively, extreme care should be exercised to ensure that the crop system can be handled adequately with the given power unit. Because of the difficulty of finding farmers who will work together, cooperative ownership and use of equipment has definite limitations. By and large, cooperative arrangements will work best when father and son, or brothers, own and operate as a single unit.

5. The use of reliable second-hand equipment may make possible lower power and equipment costs. If the use of second-hand equipment is contemplated, extreme care should be exercised in its appraisal and purchase. This opportunity is especially applicable to small farmers with limited resources.

6. Small tractors and small equipment can be operated at lower cost than larger machines. Adapt the power unit to the job. In the delta cotton areas, however, there is danger of buying tractors and equipment that are too small for effective land preparation. Before selecting small equipment, be sure that it is large enough to do the job. In deciding upon the most economical size of power unit, timeliness of performing farm operations and the cost of labor should be considered. As a rule,

one-row tractor units are not practicable in the delta even on small farms.

7. Depreciation and repairs make up a large proportion of the total costs of operating the power unit and equipment. Any extension in useful life through better care results in lower costs of operation. Proper lubrication and timely repairs result in lower total repair costs and hence lower costs of operation per day, per hour, or per acre.

SUMMARY

1. The adoption of tractors for farm power has proceeded rapidly in the Mississippi River Delta Cotton Area since 1940. The number of tractors on farms in the area increased from 551 in 1930 to 1711 by 1940. From 1940 to 1944 the number of tractors more than doubled—from 1711 to 3767.

2. Farms included in the farm mechanization study were stratified by size into four representative groups that were typical of most farming systems in the delta cotton areas of Louisiana. The size groups were as follows: less than 50 acres in crops, 50-149 acres in crops, 150-299 acres in crops, and over 300 acres in crops but less than 1,500 acres.

3. The average cost of operating 179 tractors based on 1944 price-cost relationships amounted to $5.58 per 10-hour day, or 56 cents an hour. Cash expenses for fuel, oil, grease, repairs, and service labor amounted to $3.60, while overhead costs for depreciation and interest accounted for the remaining $1.98 per 10-hour day.

4. The average cost of operating small tractors of less than 17 drawbar horsepower was $4.85 per 10-hour day; medium-sized tractors from 17 to 27 drawbar horsepower, $5.45 per 10-hour day; and large tractors, 27 horsepower and over, $6.09 per 10-hour day.

5. The number of days that a tractor was used annually was an important factor affecting the cost of operation per day or per hour of use. For tractors that were used on an average of 45 days a year the cost of operation per 10-hour day was $7.37. This compares with a cost of $5.58 per 10-hour day for all tractors, which were used 95 days per year, and $4.63 per 10-hour day for those tractors that were used over 120 days a year.

6. The average annual cost of keeping workstock at 1944 prices was $198.55 per head. When workstock were used less than 30 days per year, the annual cost per head was $162.97; 30-59 days per year, $178.75; 60-89 days per year, $206.52; and more than 90 days per year, $225.21.

7. The cost per hour of use is exorbitant when workstock are maintained in working condition and are not fully used as a source of power. The cost per hour of use was $1.17 for workstock that were used less than 30 days per year, $0.44 for those used from 30-59 days, $0.27 for those used 60-89 days, and $0.21 for those used over 90 days per year.

combines and hay balers, averaged 18.5 cents for all farms.

8. The cost per hour of use of all tractor equipment, excluding

9. The cost of operating all mule equipment averaged 2.7 cents per workstock hour on all farms included in the mechanization survey. On small farms where workstock were the only source of power the cost of all workstock equipment was 3.1 cents per workstock hour.

10. The average annual cost of operating combines was $171.45 for those with the power take-off and $232.49 for those with an auxiliary motor. An average of 99 acres was harvested annually by combines with the power take-off at a cost of $1.73 an acre. Combines with an auxiliary motor were used to harvest an average of 119 acres at a cost of $1.95 an acre. The efficiencies gained through the use of combines with an auxiliary motor most probably offset the additional cost of operation, according to the farmers interviewed.

11. The average annual cost of operating hay balers was as follows: stationary tractor-powered balers, $33.69; stationary balers with an auxiliary motor, $69.65; and pick-up balers, $183.22. The acreage harvested was greatest for pick-up balers, an average of 164 as compared with 102 acres for stationary balers with the auxiliary motor and 97 acres for stationary tractor-powered balers. The cost of operating balers per acre was $1.12 for pick-up balers, $0.68 for stationary balers with an auxiliary motor, and $0.34 for stationary tractor-powered balers.

12. The adoption of one medium-sized tractor provides sufficient power to displace 6 head of workstock. Workstock numbers had not been reduced to this extent on the farms surveyed; consequently, over-all power costs were higher than necessary on the farms surveyed and may be reduced significantly.

13. The type of power used in crop production is an important factor affecting total labor requirements and the distribution of these requirements throughout the year. Labor requirements were reduced substantially when mechanized methods of production were employed, ranging from a reduction of 9.9 per cent for cotton, which was only partially mechanized, to 47 per cent in the production of oats.

14. The distribution of power requirements for crop production throughout the year largely determines the maximum acreage that can be operated by a single power unit.

15. Many opportunities exist on farms in the delta cotton areas for sizable reductions in the cost of power and equipment. Some of the more important means of reducing costs are as follows: reduction in workstock, increased annual use, more custom work, efficiently sized farms, cooperative ownership, wise purchase of good second-hand equipment, adaptation of the power unit to the farm and to the job to be done, and better care of tractors and equipment.

APPENDIX TABLE 1. AVERAGE PURCHASE PRICE OF COMPLEMENTARY TRACTOR EQUIPMENT AND ANNUAL OPERATING COSTS PER MACHINE ON FARMS REPORTING, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Item	Number	Size	Average purchase price	Average age	Useful life left	Total estimated life	Annual depreciation	Annual repairs	Annual interest[2]
			dollars	years	years	years	dollars	dollars	dollars
Disc	129	6-7 feet	187	4.5	7.1	11.6	16.11	22.15	5.61
Disc	20	8-9 feet	198	5.7	8.1	13.8	14.42	26.68	5.94
Middlebreaker	2	1 row	125	6.5	9.5	16.0	7.81	6.50	3.75
Middlebreaker	94	2 row	162	4.6	8.7	13.3	12.20	12.55	4.86
Middlebreaker	14	3 row	172	3.5	10.0	13.5	12.75	13.14	5.16
Disc plow	27	2 pan	174	6.0	8.5	14.5	12.04	13.08	5.24
Disc plow	44	3 pan	200	4.9	7.8	12.7	15.75	22.41	6.00
Disc plow	3	4 pan	226	6.0	6.7	12.7	17.80	18.33	6.78
Disc plow	3	5 pan	254	4.3	5.7	10.0	25.40	11.67	7.62
Harrow	42	8-12 feet	48	3.8	4.5	8.3	5.76	4.76	1.43
Harrow	15	14-16 feet	83	5.3	5.6	10.9	7.62	7.67	2.49
Planter	38	2 row	128	3.2	8.9	12.1	10.57	6.23	3.84
Planter	4	4 row	300	3.8	10.0	13.8	21.72	12.25	9.00
Cultivator	124	2 row	162	3.8	8.2	12.0	13.51	19.82	4.86
Cultivator	9	4 row	281	3.2	9.1	12.3	22.87	21.11	8.44
Grain drill	39	8-14 feet	196	5.9	7.9	13.8	14.20	9.47	5.88
Mower	53	6-7 feet	145	3.6	6.2	9.8	14.81	25.63	4.36
Rake (side delivery)	16	8 feet	149	5.1	8.3	13.4	11.09	5.11	4.46
Rake (side delivery)	1	9 feet	165	1.0	14.0	14.0	11.00	3.00	4.95
Rake (side delivery)	2	10 feet	190	3.0	2.5	5.5	34.55	10.00	5.70
Rake (dump)	4	8 feet	45	7.8	9.5	17.3	2.60	4.50	1.35
Rake (buck)	6	8-12 feet	84	2.8	7.5	10.3	8.19	9.17	2.53
Stalk cutter	34	2 row	98	2.8	9.6	12.4	7.89	7.93	2.93
Trailers	12	2 wheel	84	3.7	8.1	11.8	7.14	10.00	2.53
Trailers	46	4 wheel	152	5.3	8.1	13.4	11.32	17.54	4.55

[1]Average for 120 farms reporting, 94 farms with tractors.
[2]Interest charged at 6 per cent on one-half of the average purchase price.